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in Acute Naso-Pharyngitis.

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PARALYSIS OF THE VELUM PALATI IN ACUTE NASO-PHARYNGITIS.*

By CHARLES H. KNIGHT, M. D.

PARALYSIS of the velum palati is a familiar sequel of diphtheria; its occurrence in the course of a simple inflammation is so uncommon as to have escaped reference in many of the text-books. Its infrequency appears somewhat remarkable in view of the construction of the soft palate and its proximity to parts especially prone to acute inflammation. Interference with the function of a muscle or set of muscles by an inflammatory process is a matter of common observation, yet the velum palati, which is substantially a muscular structure, covered by a rather thin and delicate layer of mucous membrane, seems to be but seldom hindered in its action in the ordinary form of acute nasopharyngitis. Only the anterior third of the soft palate is made up largely of fibrous tissue; its remaining portion consists of interlacing muscular fibers under the control of motor nerves derived from a variety of sources. We are, therefore, not surprised to meet with cases of paralysis limited to one of these muscles or groups of muscles, supplied by a nerve in whose course or at whose origin may exist some form of lesion. In the case the notes of which

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will be read the question of nerve distribution is of secondary importance, since the paralysis was bilateral and seemed to involve all the muscles of the velum, and to some degree the superior constrictor of the pharynx. In other words, the paralysis was peripheral and may have been due simply to engorgement of the tissues with the products of inflammation.

Wagner states that cases of paralysis of the soft palate after catarrhal angina have been reported by Barascut, Lucé, Bergeron, and others (von Ziemssen's "Cyclopædia," vol. vi, p. 895). It has been met with during convalescence from typhoid fever by Trousseau (quoted by Broadbent) and by Gubler ("Arch. gén. de méd.," 1860, vol. i, p. 402), and the former observer says that the affection may follow simple sore throat. Two interesting cases have been reported by Broadbent, both in children; in one the larynx also being involved ("Trans. of the Clin. Soc.," 1871, iv, 92). In the discussion on this subject at the London Clinical Society, several other cases were referred to (London "Lancet," 1871, i, 308). The most recent case that I have been able to find is briefly related by Lichtwitz, in the course of an elaborate paper on "Disturbances of Speech in Affections of the Velum Palati, of the Naso-Pharyngeal Cavity, and of the Nasal Fossæ" ("Rev. mens. de laryngol.," etc., Jan. and Feb., 1886). There seems to be some doubt in the mind of the reporter as to the authenticity of the case, since it was not under his own observation. The patient was ten years of age, and rapidly improved under faradization.

My own patient was a girl, nine years of age, with a good family history. She had measles three years ago and scarlatina one year ago, both diseases of mild type, and neither leaving any sequelæ. Six months ago she had general chorea for two months, which disappeared after the patient had spent a few

weeks in the country. Three weeks ago she had a violent "cold in the head," and in the course of five or six days awoke one morning and found that her voice had become "nasal," and that in attempting to swallow fluids they would pass forward through the nose. Nasal respiration had been hitherto impeded but not entirely obstructed. There had been no epistaxis and no constitutional disturbance whatever.

The mother, a very intelligent woman, insists that the child seemed to be as well as usual, went to school, played with her companions, and had an extraordinary appetite throughout. She states that the discharge from the nose was that of an ordinary "cold in the head," that nothing resembling false membrane at any time appeared, and that, so far as known, the child had neither been exposed to diphtheria nor conveyed disease to any of her playmates. The condition described persisted as regards the character of the voice, although ability to swallow fluids improved, for two weeks, when she was brought to me at the Northern Dispensary. There was then complete paralysis of the velum palati without anæsthesia. There was no impairment of hearing, and the sense of smell was in great degree retained. The voice resembled that of a person with cleft palate, words containing nasal sounds being especially unintelligible. There was no difficulty in swallowing solids, but fluids had to be taken with some caution. There seemed to be but little interference with nasal respiration. Anterior rhinoscopy showed merely slight congestion of the mucous membrane over the turbinated bones and of that covering the septum. Posterior rhinoscopy was found to be unexpectedly difficult, for, although the velum hung perfectly relaxed, the faucial region was extremely sensitive, and the little patient was very nervous. With the aid of a 4-per-cent. solution of cocaine sprayed into the fauces a good view was finally obtained. The surface of the naso-pharynx was seen to be covered by a layer of secretion of a perfectly white color. It was moist and non-adherent, being easily removed by means of a spray of Dobell's solution. It was entirely free from odor. Its removal exposed an intensely congested and swollen mucous membrane, every part of the post-nasal region and of the naso-pharynx being involved. There

was no ulceration. Not the least remarkable feature of the naso-pharyngitis was that the process showed no tendency to extend beyond the region primarily affected. The tonsils and the pillars of the fauces were almost normal, the oro-pharynx was congested to only a slight degree, while the larynx remained entirely exempt. The child had no cough and never developed reflex symptoms of any kind, or the least constitutional disturbance. There was never the slightest pain, and, in fact, the chief subjective symptom complained of was the discomfort resulting from nasal obstruction and rapidly accumulating secretion. It should be added that the child's general condition was bad. Although not distinctly strumous, she was pale and anæmic.

The treatment consisted of thorough cleansing of the naso-pharynx, by means of a spray of Dobell's solution, through the mouth and through the anterior nares, followed by a posterior spray of a five-grain solution of nitrate of silver, the latter being used only every other day. Nux vomica and quinine, and subsequently a preparation of iron, were used internally. At the end of a week improvement was obvious, and in about six weeks no trace of the trouble remained.

This case, in itself of relatively trivial importance, became of unusual interest to me from the fact that it drew my attention to the great variety of functions performed by the velum palati. The subject has been studied by a number of observers. Cases in which the naso-pharyngeal cavity had been exposed by removal of an orbital tumor gave to Gentzen and R. Falkson ("Arch. für path. Anat. u. Physiol. u. f. klin. Med.," 1880, B. lxxix, 477) the opportunity of taking sphygmographic tracings of the movements of the soft palate. A similar case has been observed by Hilton ("Guy's Hosp. Rep.," i, 1836, 493). Atrophy of the turbinated bones has been utilized by Voltolini ("Die Rhinoskopie und Pharyngoskopie"), Michel ("Berl. klin. Wchuschr.," No. 34, 1873, No. 41, 1875), and Zaufal ("Arch. für Ohrenheilk.," ix, 1875, 133) for inspecting the

movements of the velum. Cases of destruction of the superior maxilla gave to Bidder and Schuh their means of observation ("Wiener med. Wchnschr.," 1858, No. 3, 33-36), while G. Passavant made his explorations through an aperture resulting from extensive loss of the palate-bones ("Arch. für path. Anat. und Physiol. u. f. klin. Med.," 1869, B. xlv, H. i). Finally, Lennox Browne has succeeded in showing the various positions of the velum during phonation by means of photography ("Voice, Song, and Speech"). In the act of breathing, the soft palate has been found to rise with inspiration and fall with expiration. It does not appear, however, that this movement has any special significance beyond possibly facilitating drainage of secretion from the nasal chambers. In the acts of smelling and of sucking, the soft palate plays a very important part. Its indispensable relation to the proper performance of deglutition and of phonation is now and then impressed upon us in a very striking manner in cases of destructive ulceration in the course of syphilis. It is in phonation, and especially in the use of the singing voice, that the velum presents many of its most interesting features. We are accustomed to think of the larynx as the organ of voice, and perhaps give too little consideration to the rôle played by accessory structures, the lips, the teeth, the tongue, and, by no means least important, the velum palati. Indeed, the cases of Czermak and of Bourguet, quoted by Lichtwitz, indicate that the larynx is not even essential to vocalization. These patients, both wearing trachea-tubes—the former on account of complete obstruction of the larynx, and the latter in consequence of having attempted suicide by cutting his throat—are said to have learned the articulation of certain words by a process of "storing up" air within the mouth. The latter patient "could speak during inspiration as well as expiration."

In an interesting article by Edward Smith, "On Certain Movements of the Throat and Chest in Respiratory Acts" ("Dubl. Quart. Jour. of Med. Sci.," 1862, 19), the statement is made that in chest tones the velum takes the position it holds in ordinary conversation, and neither pitch nor quality is influenced by any motion of the uvula. In medium tones the velum and the uvula begin to draw up, and in head tones the palate is in a state of extreme tension, the nares being shut off. On the other hand, Gordon Holmes says ("Vocal Physiology and Hygiene") that while it is *possible* to sing all the chest-notes without moving the soft palate, a great loss of resonance results, so that, in order to secure a pure tone, the palate must rise step by step with the ascending scale. In the use of the falsetto voice the velum reaches the extreme of contraction, but this phenomenon would seem, after all, to be merely a coincidence, since falsetto notes are still possible after loss of the soft palate. The explanation of this fact is found in the action of the palato-pharyngei muscles, whereby the alæ of the thyroid cartilage are made to approximate. According to Lennox Brown, the elevation of the palate is not so great in falsetto as in corresponding chest tones.

An ingenious instrument has been devised by Dr. Harrison Allen, of Philadelphia, for recording the movements of the soft palate ("Trans. of the Coll. of Phys.," Philadelphia, 1884, p. 165). The instrument consists of a slender metal rod, with one end bulbous, which is introduced through the nostril and allowed to rest upon the posterior surface of the velum, while the shaft of the rod is supported at the tip of the nose by a flexible copper wire attached to an ordinary mirror head-band. The anterior extremity of the rod projects about four inches from the nose, and is made to impinge upon the surface of an upright revolving cylinder with clock-work mechanism, known as Ludwig's

kymographion. The movements of the palate in contact with the bulbous end of the *palate-myograph*, as Allen calls his instrument, are recorded during phonation upon the surface of the cylinder, which has previously been covered with carbonized paper, in a series of curves. It has been found that these curves vary in size, in different experiments, on account of the difficulty of always reaching precisely the same point with the bulbous end of the rod. Moreover, the palate is only partially under control of the will, and it, like other muscular tissue, may become fatigued or may act irregularly from prolonged irritation caused by the bulb. The size of the curves varies in different individuals. However, it seems to have been demonstrated that the *number* of curves for a given sound is invariable in the same person, and varies but slightly in different individuals. It is suggested that the instrument may be of practical value in a study of "stammering and in determining the degree of degeneration of the levator palati muscles in progressive dry aural catarrh." It may also be of use in the comparative study of language, in the instruction of the deaf, and in the formation of a system of phonography. Whether these various practical applications of the instrument may or may not be reasonably expected, the results of Dr. Allen's experiments are certainly very interesting and curious. In spite of the apparent ease of determining the varying positions assumed by the palate for different sounds, especially where the region has been exposed by deformity, by disease, or by surgical intervention, considerable differences have prevailed in the conclusions reached by different observers. In general, however, the results may be summarized as follows: The palate is loosest for the sound *ah*, tighter for *ai*, still tighter for *oh*, even more tense for *oo*, and reaches the extreme of contraction for *ee*. The degree of contraction for consonants depends somewhat

upon the quality of vowel-sound entering into their composition. The velum rises least for *m* and *n* and highest for *k*. It is recognized that the timbre of the voice becomes altered in character corresponding with the location of disease in the nasal passages—for instance, the quality of the voice in the case of obstruction of the anterior nares and in case of adenoid disease of the vault of the pharynx is quite different. In accordance with the suggestion of Lichtwitz, advantage may be taken of this fact to differentiate the site of a neoplasm, hypertrophy, or other lesion. In conclusion, involvement of the velum palati may be confidently assumed in case of defective pronunciation of the explosive consonants, *b*, *d*, *g*, *k*, etc., together with exaggerated resonance in emission of the vowel sounds.



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